

Traffic Noise Pollution and Its Health Implications on Humans: A Review

Vaibhavi Kulkarni¹, Manoj Yadav², Parul Saler³

¹MTech Scholar, Department of Civil and Environmental Engineering, KIT's College of Engineering (Autonomous), Kolhapur, Maharashtra, India.

²Assistant Professor, Department of Civil and Environmental Engineering, KIT's College of Engineering (Autonomous), Kolhapur, Maharashtra, India.

³Assistant Professor, Department of Civil and Environmental Engineering, KIT's College of Engineering (Autonomous), Kolhapur, Maharashtra, India.

Abstract - This article covers the literature on traffic noise studies undertaken in India and other countries during the last three decades. Road traffic noise studies in India are sparse and limited to major cities. Monitoring, recording, analysis, and modeling have all been studied over the years. According to the findings of this review search and analysis, there is extremely little research linking traffic noise to health effects. The examination of publications revealed that road traffic noise irritates respondents to varying degrees. Almost all Indian cities have exceeded noise pollution restrictions. Violations are most common in cities. To control this ever-growing risk, India's laws must be properly applied.

Key Words: Road Traffic Noise, Health Implications, Systematic review, Questionnaire Survey, Annoyance, Sleep Disturbance, Noise Monitoring

1. INTRODUCTION

Over the past century, there has been a tremendous increase in the human population. The need for goods like food, water, housing, electricity, transportation, and many other things have risen as a result. These demands are putting a lot of strain on our natural resources and are also causing air, water, and soil pollution[1]. Noise is one of the major pollutants along with these other pollutants. Nowadays, noise pollution has become one of our main concerns due to numerous sources of noise. This includes noise produced by moving vehicles like cars, trucks, aircraft, trains, buses and other sources like construction activities, industrial noise[2]. Fireworks lit on various cultural festivals, fairs, wedding ceremonies not only cause air pollution, but also high intensity of sound wave, which increases problem of noise pollution.

Noise pollution can have a physical and psychological impact on humans[3]. Constant noise and harsh sounds cause deafness, headache, increase in blood pressure, nausea, various effects on nervous system[4]. There is an increase in mental health disorder due to high impact of noise[5][6]. Annoyance is the most common and well researched subjective reaction to noise[7][2]. The

common consensus is that noise annoys and irritates people by interfering with their activities and ability to communicate. Anger due to noise pollution can result in stress, illness, lack of control and aggressive behavior[8].

Noise exposure disrupts sleep and alters sleep patterns. When there is noise, it takes longer time to enter a deep sleep[9][10]. This resulted in subpar performance and a lack of focus[11]. Also, loud noise hampers the communication causes speech interference and performance[12]. More error happens due to lack of concentration[13][14]. According to several studies, there may be a small reduction in birth weight of the child if the mother is exposed to high levels due to noise pollution during pregnancy[15]. It seems from research of young children and babies that boys are more prone to persistent noise-related issues than girls.

The perception survey results will be used to investigate the relationship between individual response scores for the physical and psychological health effects of noise pollution, also useful to gather the peoples' personal opinion[13]. Noise does not affect all the people the same way[16]. Individual sensitivity to sound varies significantly. Furthermore, people are affected differently at home and at work. According to studies questionnaire-based surveys are useful for identifying specific noise sources and developing noise-reduction strategies. Individual perceptions of noise pollution may reflect the social dimensions and circumstances under which people perceive pollution.

1.1 Literature Review

Stansfeld et al[3]. (1993) investigated the link between noise level exposure and psychological disorder. The questionnaire survey was administered to 2398 males. Men with high sensitivity were more irritated by noise exposures, according to the findings.

Evans et al[17]. (2000) This study looked at how changes in environmental quality affect children physical and mental health over time. The sample consists of 115

fourth-grade children drawn from a large, representative sample of children living in Tyrol's lower Inn Valley. This study focused on children's noise annoyance, cognitive processing, and stress. The resting systolic blood pressure of children in the noisier areas was higher.

Stansfeld et al [18]. (2000) The paper explains the non-auditory effects and Psychological effects on adults as well as children. People who exposed to 75dBA for 15 min among those have higher heart rate.

Tripathi and Tiwari [4] (2006) A questionnaire based study was conducted among randomly selected 86 traffic policemen. According to demographic characteristics 86% policemen recently joined the duty at the time of survey. Among those 10 policemen faced the problem of tinnitus. And the result shows that 95.3% policemen never used earplugs/ muffs.

Amit Prakash et al [19]. (2006) Noise levels measurement was done for different types of vehicles in Delhi city. Number of 30 vehicles used for each mode of transportation. Different noise indices were measured i.e. L10, L90, Leq. Frequency of sound was recorded and it was analyze using PRAAT software. It was found that the highest peak noise that means L10 measured for auto-rickshaws. Maximum value of L90 was for rural transport vehicles as well as for Leq inside level was less than outside vehicle level.

Murthy et al [20]. (2007) Evaluation of traffic noise levels was done using sound level meter in 10 different locations. Minimum and maximum noise levels were measured. High noise levels were observed during this study. According to perception survey results, 43% respondents had the problem of headache.

Lambert et al [7]. (2008) A survey was conducted in France for the people above the age group of 18. They were asked 69 questions for the survey. 56% considered that noise pollution happened due to transportation. In France almost 70% population agreed that road traffic noise was the main source of noise. On basis of survey 57% population answered that they were annoyed by transportation noise during evening time.

Mishra et al [21]. (2009) It is an empirical study based on the survey of 200 respondents. The respondents were interviewed according to age group, gender, educational level, income level, who were affected by noise pollution. From the results, among the age group of 40-60, 61% people faced the problem of hearing.

Nejadkoorki et al [22]. (2009) Sound level measured was studied in 10 streets of the city on weekdays and holidays. the parameters used were traffic activity, street geometry, sound level (Leq) & distance to nearest intersection. A plotted graph of these parameters vs street

names was drawn which having greater noise levels than national standards

Agarwal and Swami [2] (2009) The paper shows how emerging vehicles numbers are responsible for increasing noise levels. It also highlights the relationship between attitudinal responses of the individual person and different noise indices.

Hai Yen Thi Phan et al [23]. (2009) In this study, two cities, Hanoi and Ho Chi Minh City, were chosen to investigate road traffic noise. Both towns had sample sizes of 1503 and 1470, respectively. The questions focused on the annoyance created by road traffic noise. Noise measurements were also taken in row homes and apartments. Noise seemed to irritate Hanoi respondents more than Ho Chi Minh City respondents.

Ozer et al [24]. (2009) In this paper, number of vehicles were counted to determine noise levels. Based on evaluation it clearly seems that noise level exceeded that standard limit.

Kishikawa et al [25]. (2009) A questionnaire study was carried out in residential area among 413 people of Japan. Questionnaire was based upon basic attributes like age, gender, socioeconomic status and further followed by effects due to noise exposure speech interference, sleep disturbance and they were measured in 1) never 2) rarely 3) sometimes 4) often 5) always these categories. Along with this survey sound levels were measured for 24 hours and day- night average sound levels (Ldn) in three sound level group. From Relationship between Ldn with sleep disturbance, 30% residents were faced the problem of sleep disturbance.

Omidvari M and Nouri J [26] (2009) A study was carried out in Tehran, Iran. Noise monitoring was done using sound level meter CELL-450 and Quest-2900 for three months duration. Leq, L10, Lmax, Lmin were measured in 282 locations in the main streets. Questionnaire was given to policemen to find out behavior. According to results, it was serious traffic noise problem. 73% had suffered from buzzing sounds in ears.

Ristovska [27] (2010) Sources of noise were analyzed according to level of annoyance i.e. not annoyed, moderately annoyance and high annoyance.

Firdaus and Ahmad [28] (2010) conducted a questionnaire survey in Delhi. 1693 respondents were asked to answer this questionnaire. The questionnaire consists of questions based on sources of pollution; causes of increasing pollution, as well as non-auditory effects like a rise in blood pressure, interference with communication, etc. 31.2% of respondents said that automobiles were the reason for noise pollution. The intensity of noise pollution in Delhi was very high. Annoyance was the main factor in

noise pollution. The author also suggested that generating mass awareness about the adverse effects of noise pollution would help enhance the environment.

Lee et al[9]. (2010) investigate various types of noise exposure and its effects on sleep. Road traffic noise was used as a singular noise source and construction or movie used as combine noise source. The survey that took place included 20 adults. The questionnaire was split into three sections: the first included questions asked before going to bed such as sleeping behavior, the second included premature awakening, and the third included annoyance and sleep disturbances. The findings revealed that combined sources fell asleep within an hour and raised the number of people who were awakened prematurely.

Patil et al[29]. (2011) A questionnaire based survey was conducted on socio economic characteristics and individual attitudes towards traffic noise which affected the daily activities. According to study 56% noise was generated due to horn and 73% respondents were annoyed by traffic noise.

Agarwal and Swami [30](2011) Study was done to evaluate impact of noise pollution in residential area which is nearby roads. Day-night sound level was measured in city of Jaipur. Questionnaire was used to find out individual ill effects of noise. According to final results, traffic noise was main source of noise pollution. Level of annoyance was increased due to noise pollution.

Hunashal and Patil [31](2012) Noise Indices such as Leq, Lnp, L10, L50, L90 were calculated. The graph of dB vs Time was drawn & some control measures suggested like heavy vehicles should be prohibited in commercial and residential areas during day time to control noise pollution.

Mohapatra and Goswami[12] (2012) Noise assessment was carried out in different locations to study machines, drilling and other noise. Questionnaire method among workers was carried out to evaluate noise in mining area. More than 40% workers were exposed to high noise levels.

Swain et al[32]. (2012) Monitoring of noise was done in sixteen crowded roads of Bhubaneswar. Random people were selected for questionnaire survey. This study revealed that noise levels are more than the permissible noise limit.

Pal and Bhattacharya[33] (2012) this study discussed the issue of noise pollution in relation to road traffic with human work efficiency in their working environment. The sound levels were measured in areas where high vehicular traffic was found such as side offices, organizations and commercial business centers. Along with this questionnaire survey was carried out to find personal

responses. Traffic jams are caused due to heavy vehicles in these areas. Most of the respondents reported that they get disturbed during their work.

Keerthana et al[34]. (2013) In this paper analysis was done on vehicular traffic noise during the morning peak period i.e 6.30 -9.30 am and evening peak period (6.30-9.30 pm) in city of Tirupur city. Along with this total vehicular volume per hour, temperature, relative humidity were calculated. Based on results city had critical problem of noise pollution. Noise level more than 85dB found in most of areas. Author also suggested ways of minimization like use of noise barriers, limitations on vehicular speed.

Singh and Pandey[35] (2013) The study was carried out at different zone/areas; the data was collected for 10 hrs per day. it was observed that most of the areas in city had higher noise level than permissible noise standards. & author recommended few control measures.

Ahmad and Sarkar[36] (2014) In this paper traffic volume survey was carried out along with noise monitoring in two roads of Delhi city and developed variations between them.

Berg et al[10]. (2014) in this paper author finds correlation between responses to noise annoyance and sleep disturbances. 3817 randomly people were selected for the survey. From the results of paper, noise annoyance was more in elder people hence they used sleeping pills.

L Barregard et al[37]. (2014) the purpose of this study was to look into the relationships between road traffic noise exposure and hypertension. This survey was done in Sweden. Traffic noise as well as railway noise was measured for evaluation of 24 hours (Leq). 18 to 75 years of age respondents were selected for survey. Sound levels were divided into five categories based on outdoor sound levels. Evaluation of questionnaire was based on symptoms and effects caused by traffic noise. i.e sleep disturbances, annoyance, hypertension, etc. A large number of people were exposed to noise level more than 55 dBA, those people had increased in risk of hypertension.

Degeest et al[38]. (2014) Questionnaire was circulated to adults in age group of 18 to 30. 151 respondents answered this questionnaire. It was designed to evaluate tinnitus after noise exposure. Among from those 6.6% respondents were experienced chronic tinnitus.

Karin Sygna et al[5]. (2014) study was carried out in Norway. This study examined the relationship between road traffic noise with sleep quality and mental health. Assessment of road traffic noise was done at most exposed roads. From findings of this study, poor sleepers had increased symptoms of psychological distressed. Due to increase decreased of exposure to traffic noise.

Bodin et al[39]. (2015) this study was based on road traffic noise. 2612 respondents answered to survey. They had used different types of five points scale for different symptoms. For annoyance assessment; Not at all bothered or annoyed to extremely bother or annoyed. For sleep assessment; very poorly to very good. 80% people told that they were experienced noise annoyance.

Singh[40] (2016) Traffic density was determined with noise levels in day and night hours in residential, commercial and industrial areas of city. Coefficient of correlation (r) and Coefficient of determination (r^2) were calculated.

Akinyemi Patrick Ayodeji [8](2016) this study was conducted in Nigeria. Questions were design to study awareness and effect of noise pollution. 125 students were selected from one of the institute of Nigeria. Result showed that 88.20% respondents were aware that traffic congestion was the common source of noise exposure. According to 103 students, they felt that noise can affect sleep. However 99 respondents had problem of headache.

Ibrahim [14](2017) Questionnaire was given to 438 students in University to detect the noise source in classrooms, labs, campus about health effects. These noise pollution questionnaire scales was in five categories

Singh et al[6]. (2017) this article demonstrates that the population living along busy highways is constantly subjected to sound levels that exceed the allowable limits. This constant exposure to noise pollution is reason for concern because it has a number of negative effects on human health. Traffic pollution causes annoyance and irritability, as well as sleep disturbances, cardiovascular disease, stroke risk, diabetes, hypertension, and hearing loss. It has a negative impact on job performance. Inadequate understanding of the negative health impacts of road traffic noise on human health leads to a lack of noise control.

Zerihun et al[41]. (2017) Interview was conducted to evaluate people's perceptions towards noise effects. and recommendations were suggested

Jariwala et al[42]. (2017) the paper is based on comprehensive overview of adverse effect of noise pollution on human health, which explains different noise related issues.

Karina Mary Paiva et al[43]. (2018) this research focused on a tiny section of Sao Paulo, the country's largest city. The research was divided into two parts: noise assessment, including the construction of neighborhood noise maps. and the use of a questionnaire to ascertain the neighborhood inhabitants perceptions of the impact of this exposure. There were 225 interviews in total. 48.4% of respondents experienced noise-related aggravation. There

were associations found between residing in places subjected to traffic noise and feeling irritated by it. The interviewees also expressed a significant level of subjective discomfort, as well as the impact of traffic noise on their health.

Vattanantrate et al[15]. (2019) Traffic, industries, Air and railway transport are the sources of noise in Thailand. These affect the psychological as well as mental health of human beings.

Sahu et al[44]. (2019) in this papers evaluation of traffic noise was conducted in Burla town, India. Noise level was measured in different locations of cities in day time. From that, noise contour map was created to visualise the equivalent noise levels. Social survey was done in different locations. From that survey it clearly seems that equivalent noise level increased with increased in individual annoyance.

Chauhan and Bhatta[45] (2019) it was done to study noise level in educational institution in Kathmandu valley, it shows that more than 90% of the area have noise pollution problem. Students faced hearing difficulties during class session

Wu et al[11]. (2019) Assessment of noise was done in main road of city having high rise buildings. Questionnaire was based on physiological or psychological symptoms caused by traffic noise.

Das and Basak[46] (2020) Objective of this study was to measure the noise levels in four zones/areas. This study was done to investigate the physiological and psychological effects among exposed humans.

Popescu[16] (2020) the objective of study included measuring the populations degree of knowledge about urban noise. Questions were formed to calculate noise sensitivity and annoyance in the year 2009 and year 2019. Results showed that 37.2% people were disturbed by noisy environment although 50% people were disturbed in year 2019.

Wokekoro[47] (2020) carried out questionnaire survey through emails and whatsapp in the group of literate people in the general public. From the result of the study of 61 people, 97% adults were aware of noise pollution impacts on human health. 44 respondents confirmed that they had lack of concentration and other 44 had sleeplessness due to noise.

Dewan [13](2021) a public interview based on perception and awareness of traffic noise was conducted in city of Chandigarh. According to response given by public 74% people faced problem like lack of concentration. 72% respondents agreed that they were helpless when they couldn't able to get rid of noise.

Benito Zamorano-González et al[48].(2021) carried out day noise monitoring in weekdays in three time periods i.e 6.30 to 7.30 am, 12.30 to 1.30 pm and 5.30 to 6.30. Questionnaire was used to collect the data about traffic noise perception. From the observation , it showed that++ LAeq during the day exceed 70 dBA, minimum value ranging between 51.8 dBA to 61.8 dBA and maximum values fluctuating between 86.7 to 103.9 dBA. Participants from the city did not considered traffic noise to be an annoyance.

Anjum and Kumari[1] (2022) the main objective of the study was to see the effect of noise pollution levels before, after and during the COVID PANDEMIC. Noise reduction was observed during the lockdown only

Ranpise and Tandel[49] (2022) Noise pollution study was carried out in various silence zone of Surat city. Assessment was done in morning, afternoon and evening time using KIMO DB 300 sound level meter. Questionnaire survey was carried out to find out relationship between noise levels and percentage of annoyed persons. It was observed that afternoon period has low noise level than morning and evening. And through questionnaire survey people were not aware about silence zone.

Abraham et al[50]. (2022) Author carried out questionnaire survey to analyze perception and awareness among people using excel software. Responses of questionnaire were based on 5 point’s scale from highly severe to strongly disagree. Among respondents mostly people were in age group of 21- 35. According to 46% respondents’ traffic noise was highly severe.

2. The studies involved

This review article covers a total of 50 Indian and international studies that have studied on the topic of road traffic noise monitoring and its human health implications in terms of differences or similarities in methodological approach. [Table 1] mentioned all the detailed information about each research paper. This included basic information about the author's name, city or country, and year of publication. Also mentioned noise monitoring and

perception study status. This article discusses 20 Indian research papers and 30 international papers. The quality of the examined articles in light of the criteria chosen for these studies According to this review, the study population (age, gender, and sample size) was properly specified in 75% of these studies. Along with that, this includes which effects of noise on humans were observed in papers.

This table also mentioned software used for analysis. Only 20% have mentioned their names. Most of the authors used questionnaire as a survey method for research.

People from various occupations students, teachers, traffic police or random people who exposed to traffic noise were chosen; therefore, the results may not be representative of the overall community in the research region in these circumstances.

The majority of study articles conducted noise monitoring during the day. Noise monitoring parameters such as Lmax, Lmin, Leq, Ldn, and so on were also calculated.

Table 1 Summary of Indian and international studies conducted noise exposure effects of traffic noise from 1993 to 2022

Author	City/ Country	Year	Noise Monitoring	Percept ion Study	Included effects of noise	Survey Method	Sample Size	Software Used for Analysis
Stansfeld et al.	South Wales, UK	1993	No	Yes	Noise sensitivity and psychological disorder	Questionnaire	2398 Men	IBM-PC
Evans et al.	Austria	2000	No	Yes	Psycho physiological stress, Motivation, Stress symptoms	-	115 children	-

Stansfeld et al.		2000	No	No	Sleep, social behavior, cardiovascular disease, fetus psychiatric disorder, annoyance	-	-	-
Tripathi and Tiwari	India	2006	No	Yes	Hearing ability	Questionnaire	89 Traffic policemen	Epi Info 3.3.2
Amit Prakash et al.	India	2006	Yes	No	-	-	-	PRAAT
Murthy et al.	Nepal	2007	Yes	Yes	Headache, bad temper, hearing problem, loss of concentration	Questionnaire	50	Unknown
Lambert et al.	France	2008	No	Yes	Noise annoyance , sleep disturbance	Questionnaire	2000	-
Mishra et al.	India	2009	no	Yes	Effect on hearing, interference with communication, annoyance , sleep disturbance, result in deafness	Questionnaire	200	Unknown
Nejadkooki et al.	Iran	2009	Yes	No	-	-	-	ArcGIS
Agarwal and Swami	India	2009	Yes	Yes	Annoyance	Questionnaire	450	Unknown
Hai Yen Thi Phan et al.	Vietnam	2009	Yes	Yes	Annoyance, sleep disturbance	Questionnaire	2947	Unknown
Ozer et al.	Turkey	2009	Yes	No	-	-	-	-
Kishikawa et al.	Japan	2009	Yes	Yes	sleep disturbance, speech interference, sensitivity	Questionnaire	468	GHQ-28, WNS-6B
Omidvari M and Nouri J	Iran	2009	Yes	Yes	-	Questionnaire	-	-
Ristovska	Republic of Macedonia	2010	Yes	Yes	Annoyance	questionnaire	700	Unknown
Firdaus and Ahmad	India	2010	No	Yes	Rise in B.P., heartbeat, breathing, sweating, annoyance, interference in communication, nausea, headache, etc	Questionnaire	1693	Unknown
Lee et al.	Korea	2010	Yes	Yes	Sleep behavior, annoyance, effect on performance	Questionnaire	20	-
Patil et al.	India	2011	No	Yes	Annoyance , headache, nervousness, hearing damage	Questionnaire	500	Unknown
Agarwal and Swami	India	2011	Yes	Yes	Annoyance, irritation ,headache, hypertension, loss of sleep, stress	Questionnaire	550	-
Hunashal and Patil	India	2012	Yes	No	-	-	-	-

Mohapatra and Goswami	India	2012	Yes	Yes	Headache, bad temper, hearing problem, loss of concentration, cardiovascular stress	Questionnaire	365	-
Swain et al.	India	2012	Yes	Yes	Headache, mental stress, insomnia, hearing loss	Questionnaire	539	-
Pal and Bhattacharya	India	2012	Yes	Yes	headache, effect on work efficiency, loss of concentration, fatigue, stress and tiredness	Questionnaire	270	-
Keerthana et al.	India	2013	Yes	No	-	-	-	-
Singh and Pandey	India	2013	Yes	No	-	-	-	-
Ahmad and Sarkar	India	2014	Yes	No	-	-	-	-
Berg et al.	Netherlands	2014	No	Yes	Annoyance , sleep disturbance	Questionnaire	3817	
L Barregard et al.	Sweden	2014	Yes	Yes	Hypertension, annoyance, sleep disturbance	Questionnaire	1953	SAS 9.1
Degeest et al.	Belgium	2014	No	Yes	Tinnitus	Questionnaire, Audiometry	151	SPSS version 19
Karin Sygna et al	Norway	2014	No	Yes	Sleep quality , mental health	Questionnaire	2898	R version 2.15.0.
Theo Bodin et al.	Sweden	2015	No	Yes	noise sensitivity, noise annoyance, sleep quality and concentration problems	Questionnaire	2612	SPSS Statistics 20.0.2
Singh	India	2016	Yes	No	-	-	-	-
Ami Patrick Ayodejikin ye	Nigeria	2016	No	Yes	Difficulty with hearing, Undue aggression, Sleep disturbance, poor concentration, headache	Questionnaire	125	SPSS version 20
Ibrahim	Iraq	2017	Yes	Yes	temporary and primary threshold shift, high blood pressure, hearing difficulty, and lack of concentration	Questionnaire	438 students	-
Singh et al.	India	2017	No	No	Annoyance, Cardiovascular health, Hypertension, blood health , pregnancy, mental health	-	-	-
Zerihun et al.	Ethiopia	2017	No	Yes	stiffness in the ear, pain and hearing fatigue, stress, distortion of sound and interference with speech, sensitivity, dizziness, cardiovascular and physiological effect and hearing impairment	Questionnaire	298	-
Jariwala et al.		2017	No	No	Hearing Impairment, annoyance, spoken	-	-	-

					communication, sleep disturbance, cardiovascular disturbances, mental health			
Karina Mary Paiva et al.	Brazil	2018	No	Yes	Hypertension, diabetes, depression, high cholesterol and cardiovascular diseases. annoyance, sleep disorder	Questionnaire	225	-
Vattanantarat et al.	Thailand	2019	No	No	Sleep Disturbances and Cardiovascular Issues, Hearing Impairment, Interference with Spoken Communication and Mental Health, Effect on Unborn Babies, annoyance	-	-	-
Sahu et al.	India	2019	Yes	No	Annoyance	-	-	-
Chauhan and Bhatta	Nepal	2019	Yes	No	-	-	-	-
Wu et al.	China	2019	Yes	Yes	Working efficient deterioration, Hearing loss, Insomnia, Headache , Dizzy, Tinnitus, Tired, Hypertension, Flustered, Fatigue, Emotional instability, Memory loss	Questionnaire	528	-
Das and Basak	Bangladesh	2020	Yes	Yes	-	Questionnaire	40	-
Popescu	Romania	2020	No	Yes	noise sensitivity and annoyance	Questionnaire	238	-
Wokekoro	Nigeria	2020	No	Yes	headache, sleeplessness, psychological disorders, lack of concentration at work	Questionnaire	61	++
Dewan	India	2021	No	Yes	Lack of concentration, helpless	Questionnaire	515	-
Benito Zamorano-González et al.	Mexico	2021	Yes	Yes	Annoyance	Questionnaire	2350	-
Anjum and Kumari	India	2022	Yes	No	-	-	-	-
Ranpise and Tandel	India	2022	Yes	Yes	Physical and psychological impact	Questionnaire	400	-
Abraham et al.	Nigeria	2022	No	Yes	Annoyance, aggressiveness, sleep disturbance, stress , headache, ringing in ears, Hearing impairment	Questionnaire	358	-

3. CONCLUSIONS

Based on the articles reviewed for the study, the effects of noise pollution cover numerous dimensions that require consideration. The research thoroughly indicates its link to a variety of health issues, including cardiovascular illness and cognitive deficits. Prolonged exposure to loud noise has been associated with sleep disruptions, which can contribute to persistent weariness and poor general well-being. The societal impact of noise pollution extends to social relationships and community cohesion. Excessive noise, according to studies, can lead to increased hostility. Mitigating noise pollution necessitates a multimodal approach that includes tighter urban design restrictions, noise barriers, and advances in quieter technologies. Public awareness campaigns and educational programs can help develop a culture of responsible noise control by encouraging people to live calmer lives.

REFERENCES

- [1] S. Anjum and A. Kumari, "Evaluation of Noise Pollution in Bengaluru City, India During COVID-19 Pandemic," *Arch. Acoust.*, vol. 47, no. 2, pp. 131–140, 2022, doi: 10.24425/aoa.2022.141644.
- [2] S. Agarwal and B. L. Swami, "Noise Annoyance under Interrupted Traffic Flow Condition for Jaipur City," *Int. J. Appl. Sci. Eng.*, vol. 7, no. 2, pp. 159–168, 2010, [Online]. Available: <https://gigvvy.com/journals/ijase/articles/ijase-201007-7-2-159>
- [3] S. A. Stansfeld, D. S. Sharp, J. Gallacher, and W. Babisch, "Road traffic noise, noise sensitivity and psychological disorder," *Psychol. Med.*, vol. 23, pp. 977–985, 1993, doi: 10.1017/S0033291700026441.
- [4] B. Communication, "Self-reported hearing quality of traffic reported traffic policemen : A questionnaire-based study," *Indian J. Occup. Environ. Med.*, vol. 10, no. 2, pp. 82–84, 2006.
- [5] K. Sygna, G. Marit, G. Aamodt, B. Oftedal, and N. Hjertager, "Road traffic noise , sleep and mental health," *Environ. Res.*, vol. 131, pp. 17–24, 2014.
- [6] D. Singh, N. Kumari, and P. Sharma, "A Review of Adverse Effects of Road Traffic Noise on Human Health," *Fluct. Noise Lett.*, vol. 17, no. 1, pp. 1–12, 2018, doi: 10.1142/S021947751830001X.
- [7] J. Lambert and C. Philipps-bertin, "Perception and attitudes to transportation noise in France: A national survey," in *9th International Congress on Noise as a Public Health Problem (ICBEN) 2008*, 2008, pp. 3–9.
- [8] A. Patrick and O. T. Olumuyiwa, "Awareness and Self Perceived Effect of Noise Pollution among Students of Tertiary Institutions in Ilesa , South-Western Nigeria," *South Am. J. Public Heal. Spec. Ed. May 2016 Aware.*, no. May, pp. 1–7, 2016.
- [9] P. J. Lee, M. H. Shim, and J. Y. Jeon, "Effects of different noise combinations on sleep , as assessed by a general questionnaire," *Appl. Acoust.*, vol. 71, no. 9, pp. 870–875, 2010, doi: 10.1016/j.apacoust.2010.05.004.
- [10] F. van den Berg, C. Verhagen, and D. Uitenbroek, "The relation between scores on noise annoyance and noise disturbed sleep in a public health survey," *Int. J. Environ. Res. Public Health*, vol. 11, no. 2, pp. 2314–2327, 2014, doi: 10.3390/ijerph110202314.
- [11] J. Wu, C. Zou, S. He, X. Sun, X. Wang, and Q. Yan, "Traffic noise exposure of high-rise residential buildings in urban area," *Environ. Sci. Pollut. Res.*, vol. 26, no. 9, pp. 8502–8515, 2019, doi: 10.1007/s11356-019-04640-1.
- [12] H. Mohapatra and S. Goswami, "Assessment and analysis of noise levels in and around Ib river coalfield, Orissa, India," *J. Environ. Biol.*, vol. 33, no. 3, pp. 649–655, 2012.
- [13] M. Dewan and M. Dewan, "Perception and Awareness of Noise Pollution in General," *Bull. Pure Appl. Sci.*, vol. 40, no. 1, pp. 148–156, 2021, doi: 10.5958/2320-3188.2021.00018.8.
- [14] S. Abduljabbar Ibrahim, "Study Noise Effects on The Students of The Faculty of Engineering/ Mustansiriyah University," *Al-Nahrain J. Eng. Sci.*, vol. 21, no. 2, pp. 178–186, 2018, doi: 10.29194/njes21020178.
- [15] VATTANAPRATEEP. N, "Noise pollution and its impact on human health in Thailand: A review," *Pollut. Assess. Sustain. Pract. Appl. Sci. Eng.*, vol. 39, pp. 975–1026, 2020, doi: 10.1016/B978-0-12-809582-9.00019-0.
- [16] D. I. Popescu, "Case Study of the Environmental Noise and its Perception in the City of Cluj-Napoca , Romania," *Arch. Acoust.*, vol. 45, no. 4, pp. 625–631, 2020, doi: 10.24425/aoa.2020.135250.
- [17] G. W. Evans and M. Meis, "Community noise exposure and stress in children," *Acoust. Soc. Am.*, vol. 109, no. 3, pp. 1023–1027, 2014, doi: 10.1121/1.1340642.
- [18] S. Stansfeld, M. Haines, and B. Brown, "Noise and health in the urban environment," *Rev. Environ.*

- Health*, vol. 15, no. 1–2, pp. 43–82, 2000, doi: 10.1515/REVEH.2000.15.1-2.43.
- [19] V. J. Amit Prakash, Kaprosang Joute, “An estimation of annoyance due to various public modes of transport in Delhi,” *Noise Heal. A Quaterly Inter-Discip. Int. J.*, vol. 8, no. 32, pp. 101–107, 2006, doi: 10.4103/1463-1741.33950 Figures.
- [20] V. K. Murthy, A. K. Majumder, S. N. Khanal, and D. P. Subedi, “ASSESSMENT OF TRAFFIC NOISE POLLUTION IN BANEPAL, A SEMI URBAN TOWN OF NEPAL,” *KATHMANDU Univ. J. Sci. Eng. Technol.*, vol. 1, no. Iv, pp. 1–9, 2007.
- [21] R. K. Mishra, S. Rangnekar, and M. Parida, “Survey on noise pollution and its management,” *Journal of IPHE, India*, vol. 4, pp. 30–34, 2009. [Online]. Available: http://www.indiaenvironmentportal.org.in/files/Survey_on_noise_pollution.pdf
- [22] F. Nejadkoorki, E. Yousefi, and F. Naseri, “Analysing street traffic noise pollution in the city of Yazd,” *Iran. J. Environ. Heal. Sci. Eng.*, vol. 7, no. 1, pp. 53–62, 2010.
- [23] H. Yen *et al.*, “Community responses to road traffic noise in Hanoi and Ho Chi Minh City,” *Appl. Acoust.*, vol. 71, no. 2, pp. 107–114, 2010, doi: 10.1016/j.apacoust.2009.08.004.
- [24] S. Ozer, H. Yilmaz, M. Yeşil, and P. Yeşil, “Evaluation of noise pollution caused by vehicles in the city of Tokat, Turkey,” *Sci. Res. Essays*, vol. 4, no. 11, pp. 1205–1213, 2009.
- [25] S. A. S. Hiroki Kishikawa, Toshihito Matsui, Iwao Uchiyama, Masamitsu Miyakawa, Kozo Hiramatsu, “Noise sensitivity and subjective health: Questionnaire study conducted along trunk roads in Kusatsu, Japan Hiroki,” *Noise Heal. A Quaterly Inter-Discip. Int. J.*, vol. 11, no. 43, pp. 111–117, 2009.
- [26] M. Omidvari and J. Nouri, “Effects of noise pollution on traffic policemen,” *Int. J. Environ. Res.*, vol. 3, no. 4, pp. 645–652, 2009.
- [27] G. Ristovska, “QUESTIONNAIRE BASED SURVEY FOR NOISE INDUCED ANNOYANCE IN URBAN POPULATION,” *EAA-COST_2010_14 pag.2*, 2010.
- [28] A. Ahmad, “Indoor and Built Noise Pollution and Human Health: A Case Study of Municipal Corporation of Delhi,” *Orig. Pap. Indoor Built Env. 2010*, pp. 648–656, 2010, doi: 10.1177/1420326X10370532.
- [29] C. R. Patil, J. P. Modak, P. V. Choudhari, and D. S. Dhote, “Subjective Analysis of Road Traffic Noise Annoyance Around Major Arterials in Intermediate City,” *Eur. J. Appl. Sci.*, vol. 3, no. 2, pp. 58–61, 2011.
- [30] S. Citation and I. Expanded, “MEDLINE/Index Medicus and Science Citation Index Expanded,” *Noise Heal. [serial online] 2011*, vol. 13, no. 5, pp. 272–276, 2023, doi: <https://www.noiseandhealth.org/text.asp?2011/13/53/272/82959>.
- [31] R. B. Hunashal and Y. B. Patil, “Assessment of Noise Pollution Indices in the City of Kolhapur, India,” *Procedia - Soc. Behav. Sci.*, vol. 37, no. May, pp. 448–457, 2012, doi: 10.1016/j.sbspro.2012.03.310.
- [32] A. C. Pradhan, B. K. Swain, and S. Goswami, “Road traffic noise assessment and modeling of Sambalpur city, India: A comprehensive, comparative and complete study,” *J. Ecophysiol. Occup. Heal.*, vol. 12, no. 3–4, pp. 51–63, 2012.
- [33] D. Pal and D. Bhattacharya, “Effect of Road Traffic Noise Pollution on Human Work Efficiency in Government Offices, Private Organizations, and Commercial Business Centres in Agartala City Using Fuzzy Expert System: A Case Study,” *Adv. Fuzzy Syst.*, vol. 2012, 2012, doi: 10.1155/2012/828593.
- [34] N. Singhvi, “An Analysis of noise pollution in Tirupur city,” *Sch. J. Eng. Technol.*, vol. 1, no. 3, pp. 154–168, 2013, [Online]. Available: www.saspublisher.com
- [35] R. Singh and G. Pandey, “A Study of Noise in Gorakhpur City, Uttar Pradesh (India),” *Int. J. Struct. Civ. Eng. Res.*, vol. 2, no. 3, pp. 241–249, 2013.
- [36] S. A. Ahmad and P. K. Sarkar, “Traffic Noise Studies on Arterial and Collector Road in Delhi, India,” *Int. J. Struct. Civ. Eng. Res.*, vol. 3, no. 2, pp. 138–150, 2014.
- [37] L. Barregard, “Risk of hypertension from exposure to road traffic noise in a population-based sample,” *Occup. Environmetal Med.*, pp. 410–415, 2009, doi: 10.1136/oem.2008.042804.
- [38] H. K. Sofie Degeest, Paul Corthals, Bart Vinck, “Prevalence and characteristics of tinnitus after leisure noise exposure in young adults,” *Noise Heal. A Quaterly Inter-Discip. Int. J.*, vol. 16, no. 68, pp. 26–33, 2014.
- [39] T. Bodin, J. Björk, J. Ardö, and M. Albin, “Annoyance, Sleep and Concentration Problems due to

- Combined Traffic Noise and the Benefit of Quiet Side," *Int. J. Environ. Res. Public Health*, vol. 78, pp. 1612–1628, 2015, doi: 10.3390/ijerph120201612.
- [40] Ranavijai Bahadur Singh, "An Analysis of Noise levels in Selected areas of Lucknow City , Uttar Pradesh , India," *Int. J. Environ. Sci.*, vol. 5, no. 3, pp. 135–139, 2021.
- [41] S. Zerihun, H. Mamo, B. Sitotaw, and E. Mengistu, "Evaluation of the People Perception on Major Noise Source and Its Impact on Health At Dire Dawa City, Ethiopia," *Rom. J. BIOPHYS*, vol. 27, no. 2, pp. 69–78, 2017.
- [42] H. J. Jariwala, H. S. Syed, M. J. Pandya, and Y. M. Gajera, "Noise Pollution & Human Health: A Review," *Indoor Built Environ.*, no. March, pp. 1–4, 2017, [Online]. Available: <https://www.researchgate.net/publication/319329633>
- [43] K. Mary, M. Regina, A. Cardoso, P. Henrique, and T. Zannin, "Science of the Total Environment Exposure to road traf fi c noise : Annoyance , perception and associated factors among Brazil ' s adult population," *Sci. Total Environ.*, vol. 650, pp. 978–986, 2019, doi: 10.1016/j.scitotenv.2018.09.041.
- [44] A. K. Sahu, M. Pradhan, C. R. Mohanty, and P. K. Pradhan, "Assessment of Traf fi c Noise Pollution in Burla Town , India ; An Inclusive Annoyance Study," *Sound Vib.*, vol. 54, no. 1, 2020, doi: 10.32604/sv.2020.08586.
- [45] R. C. and S. Bhatta, "STATUS OF NOISE POLLUTION IN EDUCATIONAL INSTITUTIONS OF KATHMANDU VALLEY, NEPAL," *Int. J. Recent Sci. Res.*, vol. 10, no. 01(B), pp. 30693–30695, 2019, doi: 10.24327/IJRSR.
- [46] T. K. D. and R. Basak, "Noise Pollution and Its Consequences on Urban Health in Sylhet City," in *Advances in Geographical and Environmental Sciences Series*, no. April, 2020, pp. 231–252.
- [47] E. Wokekoro, "Public Awareness of the Impacts of Noise Pollution on Human Health," *World J. Res. Rev.*, vol. 10, no. 6, pp. 27–32, 2020.
- [48] B. Zamorano-gonzález, F. Pena-cardenas, and Y. Velázquez-narváez, "Traffic Noise Annoyance in the Population of North Mexico : Case Study on the Daytime Period in the City of Matamoros," *Front. Psychol.*, vol. 12, no. May, pp. 1–9, 2021, doi: 10.3389/fpsyg.2021.657428.
- [49] R. B. Ranpise and B. N. Tandel, "Noise Monitoring and Perception Survey of Urban Road Traffic Noise in Silence Zones of a Tier II City — Surat," *J. Inst. Eng. Ser. A*, no. January, 2022, doi: 10.1007/s40030-021-00598-x.
- [50] I. A. Abraham, I. B. Sunday, S. B. Saulawa, and U. A. Abubakar, "Public perception on environmental noise pollution : A case study in Zaria city , Kaduna state , Nigeria," *Environ. Heal. Eng. Manag. J.* 2022, vol. 9, no. 2, pp. 135–145, 2022, doi: 10.34172/EHEM.2022.15.